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LUMINARY Memo #236

To: Distribution

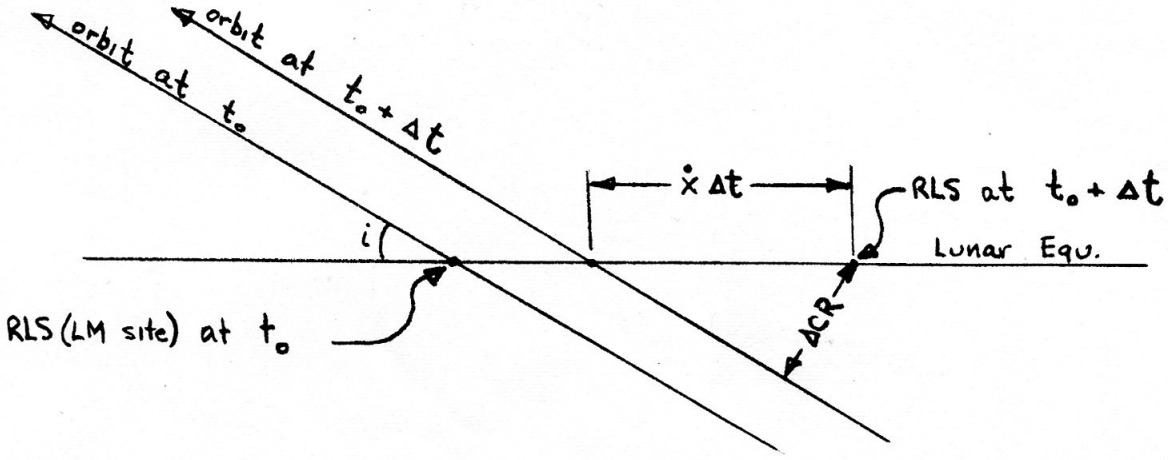
From: L. Berman

Date: 23 December 1971

Subject: Crew Corrections for Cross Range Error due to Uncompensated Orbit Precession

It has been suggested that the AGC be shut down during lunar surface operations, and be turned on periodically to update the clock and CSM position. The question arises of the necessity of updating the clock and CSM position in case of a quick lift-off.

In LUMINARY Memo #230, a brief look was taken at the problem in the case of the landing site at the lunar equator. In that situation, the error due to clock error is easy to see.



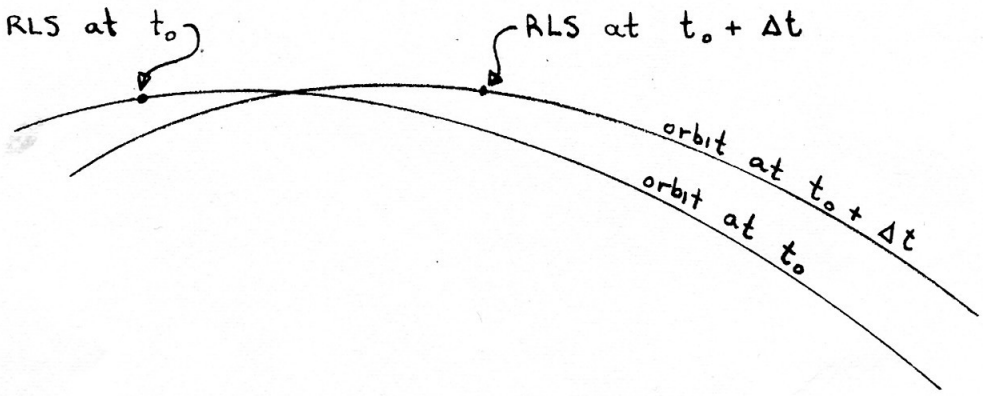
In this figure we can see that the error in cross range due to a clock error of Δt is:

$\Delta CR = \dot{x}\ \Delta t \sin i$

where $\dot{x}$ = net drift rate between RLS and the orbit line of nodes

i = orbit inclination

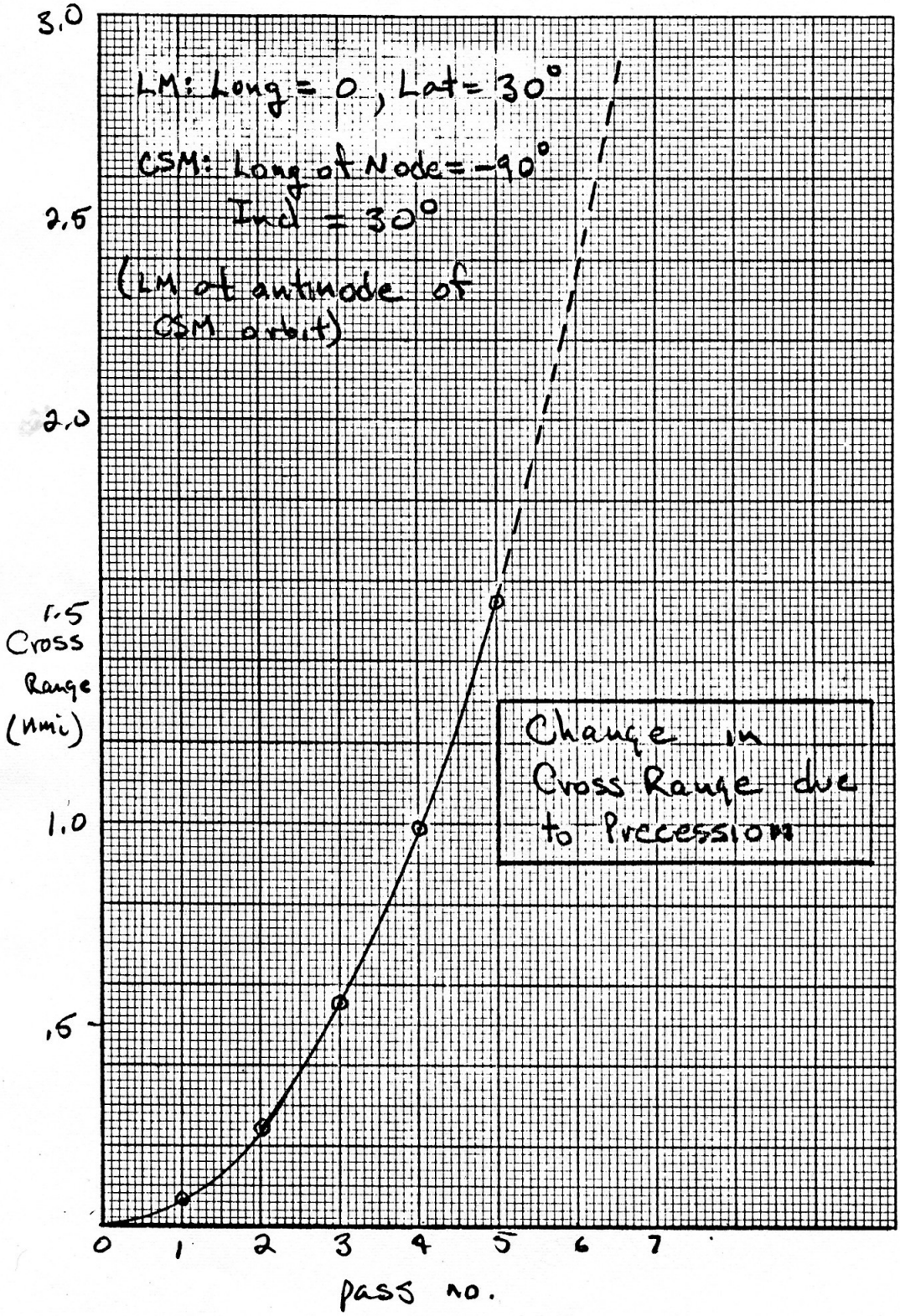
If the landing site is not at the equator, the problem is more complicated.



In this figure, the cross range at $t_o + \Delta t$ is still zero. However, that happened only because the landing site moved from one side of the anti-node to the other. During the interval, Δt, CR first went negative, and then came back to zero. As the time error increases, CR will become increasingly positive.

The attached figure shows the cross range for a 30^o CSM orbit inclination, with the LM site at the anti-node at t = 0. This type of plot could be provided for actual RLS and CSM orbit, and the crew can then modify their response to Noun 76 to include this correction.

This correction can result in the insertion point being in the CSM orbit. It does not, however, account for the changed orientation of the CSM plane, and the LM may still have an incorrect heading at insertion.


LM: Long = 0, Lat = 30°
CSM: Long of Node = -90°
Incl = 30°
(LM at antinode of CSM orbit)
Change in Cross Range due to Precession
3.0
2.5
2.0
1.5
1.0
.5
Cross Range (nmi)
0
1
2
3
4
5
6
7
pass no.